Ego Network Analysis

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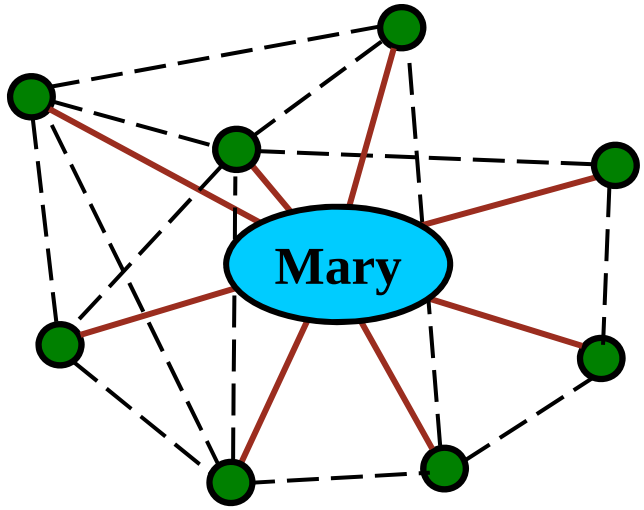
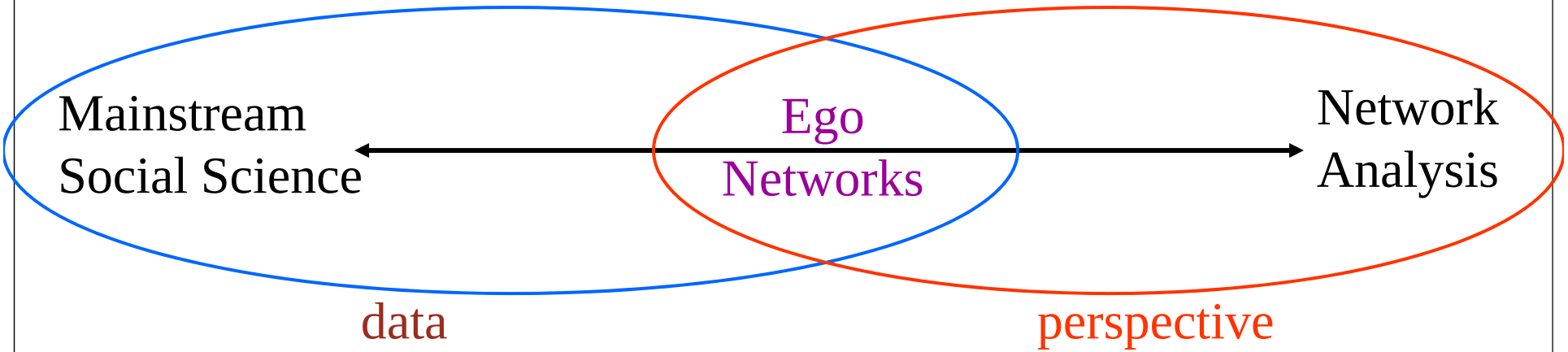
ISSH 2011 SNA track

definition

- Full network
- Ego network (aka personal network, first-order zone, 1-neighborhood , etc.)
  - Ego (the respondent)
  - Alters (actors ego has ties with)
  - Ties among the alters



A compromise



- Combine the perspective of network analysis with the data of mainstream social science

Ego net research design and data collection

sampling

- Same as ordinary social science studies
- Random/probability samples

sources

- Every full network contains every node's ego network
- (Ideally random) sample of nodes
  - Each sampled node called an "ego"
- Each is asked for set of contacts called "alters"
- Ego also asked (usually) about ties among alters
- Connections between ego's or between alters of different egos are not recorded
  - Each ego is a world in itself

Survey data collection

- Each ego ("index person") is asked for set of contacts called "alters"
  - Don't need real or complete names
- Ego asked about the attributes of each alter
- Ego asked about various dimensions of their relationship to each alter
- Ego also asked (usually) about ties among alters
- Connections between egos or between alters of different egos are not obtained
  - Each ego is a world in itself

Name generator

- Series of open-ended questions asking about the people in a person's life
  - Don't need real or complete names
  - (variant is a position generator, which asks about the types of people in resp's life)
- End result is a list of unique names that is compiled into a roster

Name interpreter

- For each alter generated by the name generator ask two sets of questions:
  - Attributes of each alter – age, sex, social class, etc.
  - Nature of the relationship with alter
    - Friends? Coworkers? Kin? How long known? Frequency of communication?
    - These questions can be same as in name generator. Difference is that the resp is reacting to roster of names, eliminating recall issues

Ego net structure

- (optional) Ask ego to indicate the ties among their alters
  - Typically a reduced set of ties, such as whether they know each other or how often they communicate with each other

Analyzing ego net data

Network size

- Same as degree
- Could be asked more simply, but less accurately, by 'how many friends have you got?'
- Well-correlated with lots of outcomes

Strength

- Average/median/maximum strength of tie with others
- How well connected to people in your neighborhood, department, etc.
- Strength of weak ties theory

Reciprocity

- Extent to which, when ego sends tie to alter, alter responds in kind
- Status differences?
- Cultural differences in meaning of social relations?

Composition

- How many of X kind of alters are in ego's network neighborhood
  - Frequency or proportion of women among ego's friends
  - Number of gay people among ego's kin

Heterogeneity

- Given attribute X, and relation Y how diverse is ego's personal network?
  - Friends mostly white? Does ego talk regularly with people from different walks of life?
  - How much variance in age in ego's friends?
- Categorical versus continuous attributes
  - For continuous vars, just use standard deviation

Categorical Heterogeneity

- Given attribute X, and relation Y how diverse is ego's personal network?
  - Friends mostly white? Does ego talk regularly with people from different walks of life?
- Herfindahl, Hirschman, Blau heterogeneity measure
  - p_k gives proportion of alters that fall into category k
- IQV – normalization of H so that it can achieve max value of 1

$$H = 1 - \sum_k p_k^2 \qquad IQV = \frac{1 - \sum_k p_k^2}{1 - 1/k}$$

Egonet Homophily

- Concept
  - To what extent an ego's alters are like ego on a given attribute
- Approach
  - Construct relational contingency table for each node
- Measures
  - Pct homophilous (%H) = 0.67
  - E-I index = -0.333
  - PBSC = 0.24

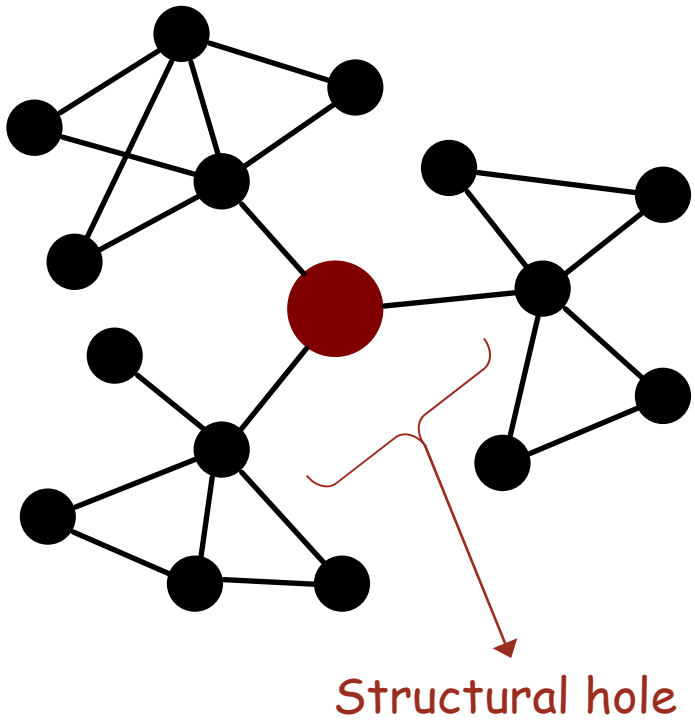
HOLLY		Same	
		1	0
R	1	2	1
	0	5	9

"Quality"

- Average/median/max of ego's alters' attributes
- E.g.,
  - How wealthy are ego's friends?
  - How prestigious?
- Lin social resource theory / social capital
  - You are as good as your network

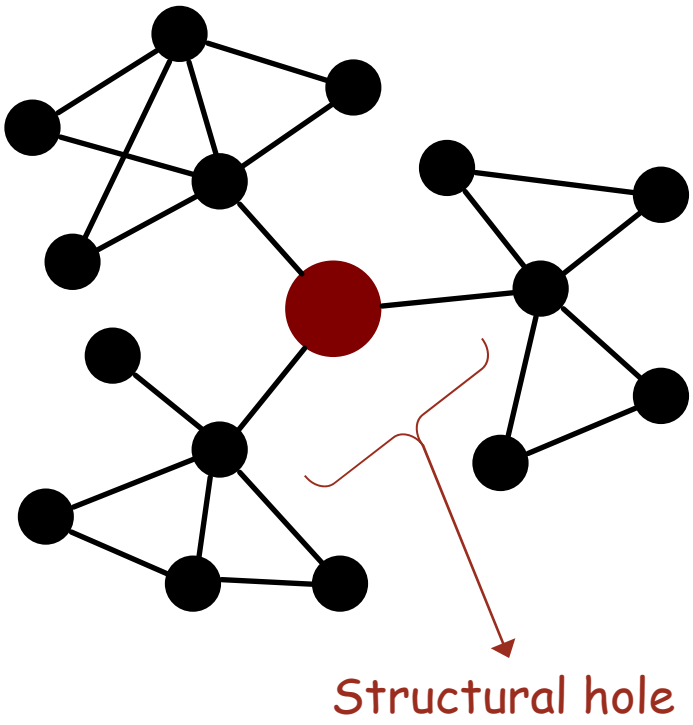
Structural holes

- Burt '92
- A theory of individual social capital
  - Predicting promotion speed
- Not based on the attributes of ego's alters, but on the structure of the ego network

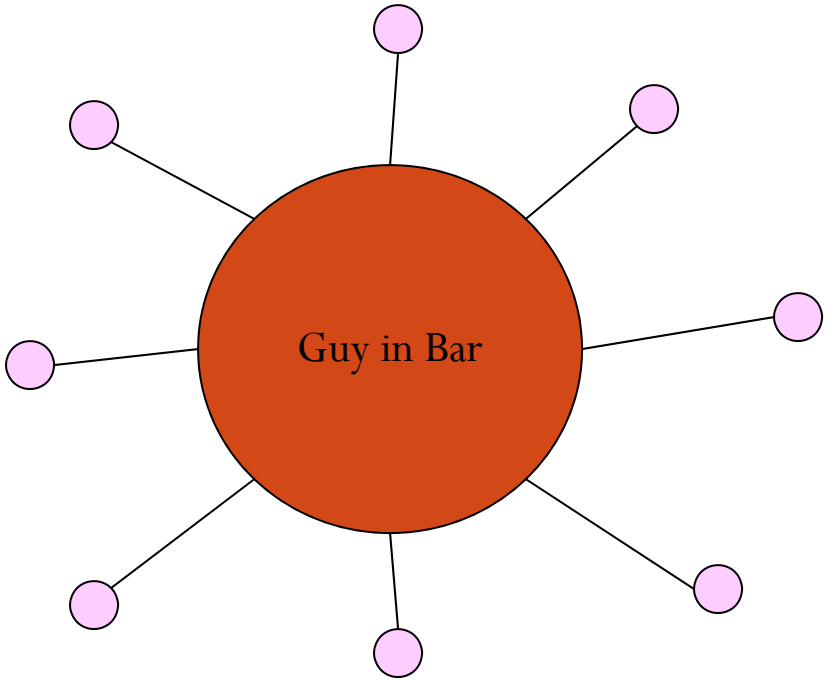


Structural Holes

- Basic idea
  - Lack of ties among alters may benefit ego
- Benefits
  - Autonomy
  - Control
  - Information

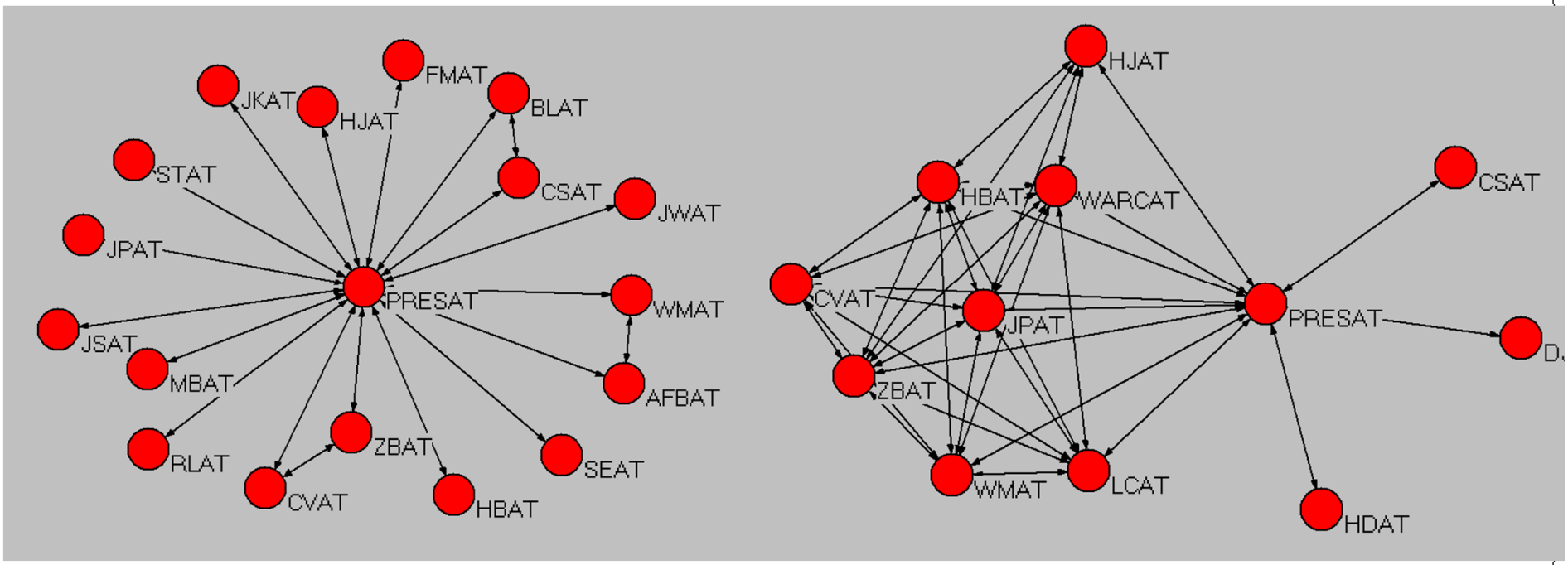


Autonomy



Control Benefits of Structural Holes

White House Diary Data, Carter Presidency



Year 1

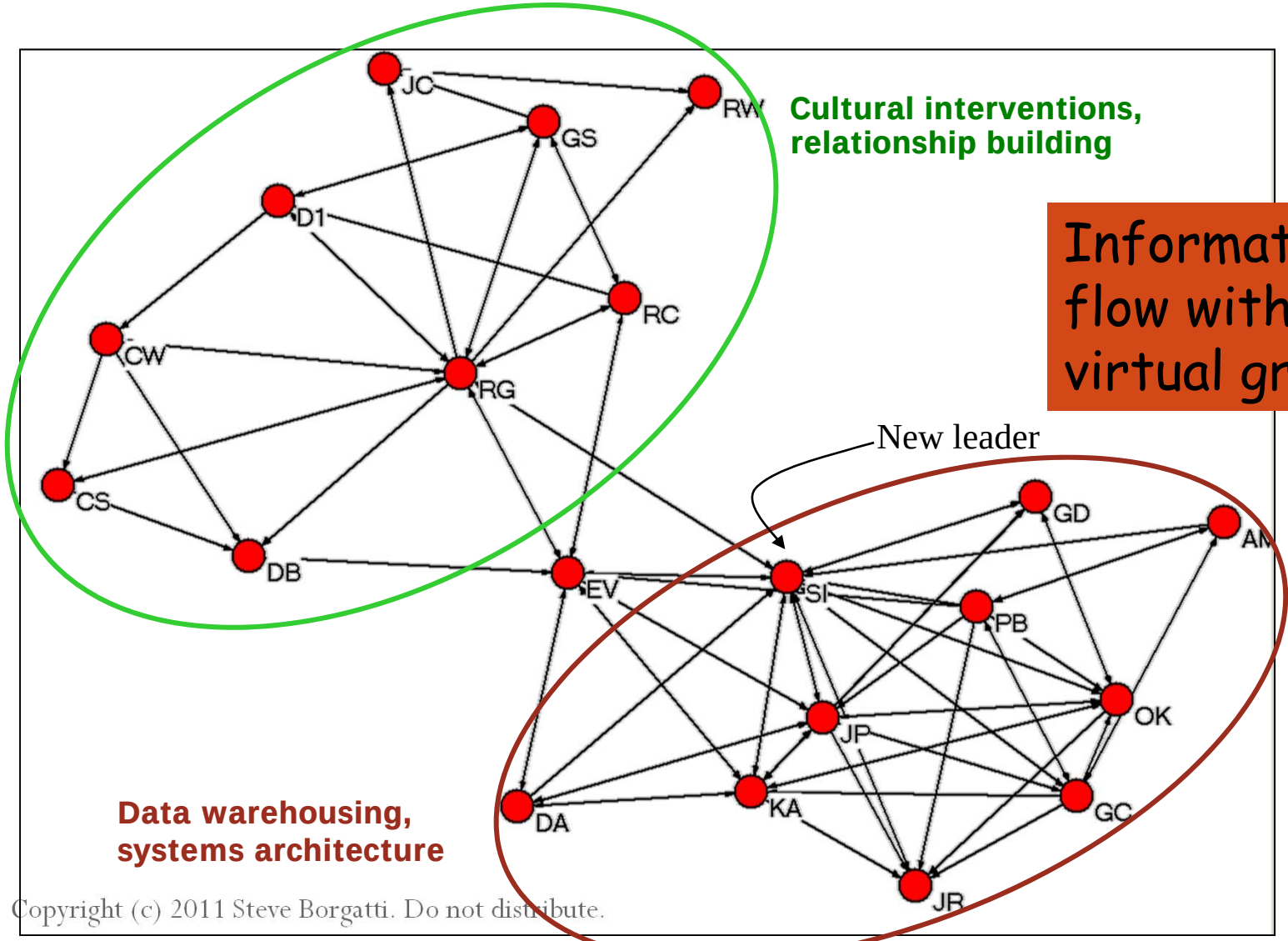
Data courtesy of Michael Link

Year 4

Information Benefits

- (Assume a fixed relational energy budget)
- Direct connection to outsiders means earlier, more actionable knowledge
- Bridging position provides control of information, agenda
- Value from
  - Bringing across ready-made solutions
  - Analogizing from others' situations
  - Synthesizing others' thinking

Information & Success



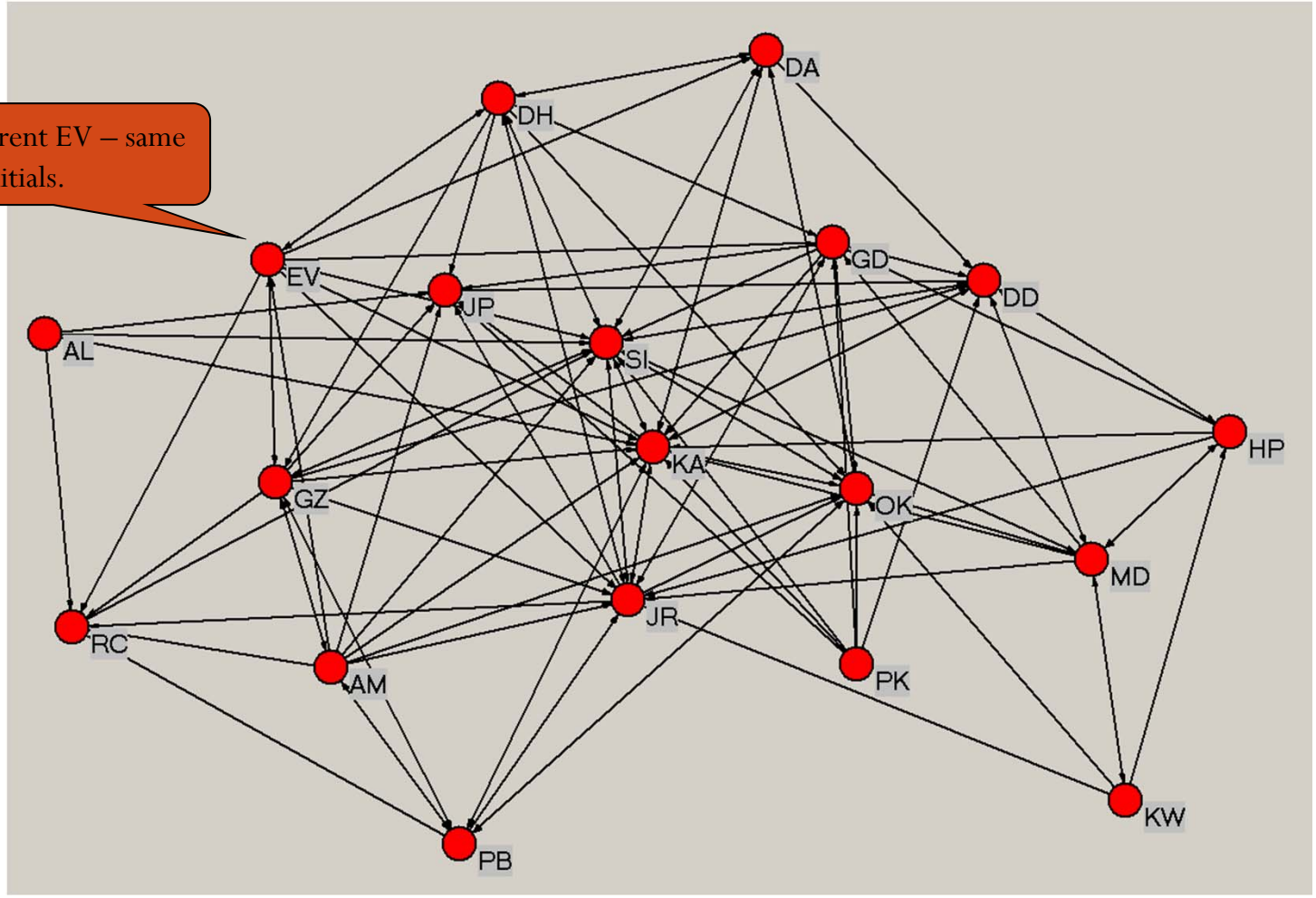
Cross, Parker, & Borgatti, 2002. Making Invisible Work Visible. *California Management Review*. 44(2): 25-46

Changes Made

- Cross-staffed new internal projects
  - white papers, database development
- Established cross-selling sales goals
  - managers accountable for selling projects with both kinds of expertise
- New communication vehicles
  - project tracking db; weekly email update
- Personnel changes

9 Months Later

Note: Different EV – same initials.



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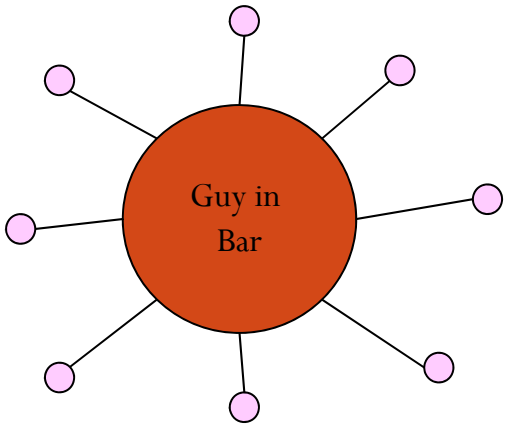
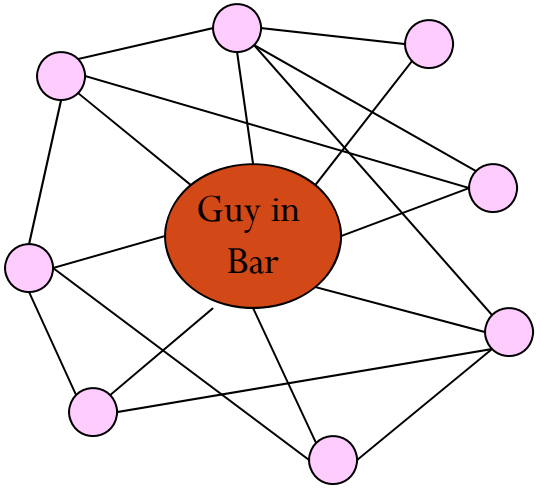
Measures of Structural Holes

- Burt's effective size
- Burt's constraint





Effective Size

m_{jq} = j's interaction with q divided by j's strongest relation with anyone

p_{iq} = proportion of i's energy invested in relation with q

$$ES_i = \sum_j \left[1 - \sum_q p_{iq} m_{jq} \right], \quad q \neq i, j$$

$$ES_i = \sum_j 1 - \sum_j \sum_q p_{iq} m_{jq}, \quad q \neq i, j$$

- Effective size is network size (N) minus redundancy in network

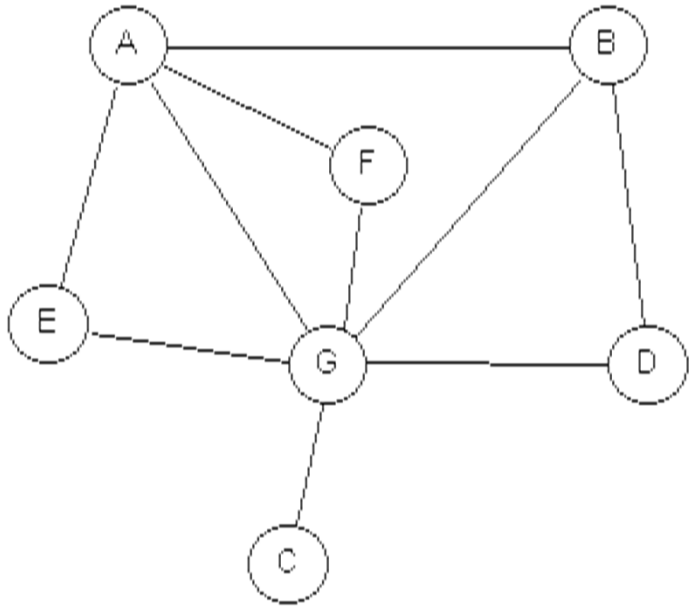


Figure 1. Adapted from Burt (1995:56)

Effective Size in 1/0 Data

- M_{jq} = j's interaction with q divided by j's strongest tie with anyone
  - So this is always 1 if j has tie to q and 0 otherwise
- P_{iq} = proportion of i's energy invested in relationship with q
  - So this is a constant 1/N where N is ego's network size
- Effective size reduce to network size minus the average network size of the alters

$$ES_i = \sum_j \left[1 - \sum_q p_{iq} m_{jq} \right], \quad q \neq i, j$$

$$ES_i = \sum_j \left[1 - \frac{1}{n} \sum_q m_{jq} \right], \quad q \neq i, j$$

$$ES_i = \sum_j 1 - \sum_j \frac{1}{n} \sum_q m_{jq}, \quad q \neq i, j$$

$$ES_i = n - \frac{1}{n} \sum_j \sum_q m_{jq}, \quad q \neq i, j$$

Effective Size

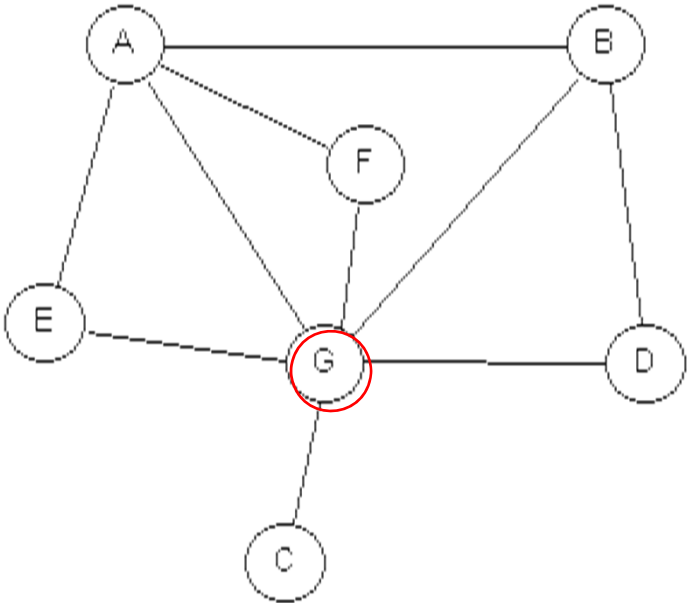


Figure 1. Adapt art (1995:56)

Effective Size of G = Number of G's Alters – Sum of Redundancy of G's alters

= 6 – 1.33 = 4.67

Node "G" is EGO	A	B	C	D	E	F	Total
Redundancy with EGO's other Alters:	3/6	2/6	0/6	1/6	1/6	1/6	1.33

Constraint

Mjq= j's interaction with q divided by j's strongest relationship with anyone

So this is always 1 if j has tie to q and 0 otherwise

P_{iq} = proportion of i's energy invested in relationship with q

So this is a constant 1/N where N is network size

$$c_{ij} = p_{ij} + \sum_{q} p_{iq} m_{qj}, \quad q \neq i, j$$

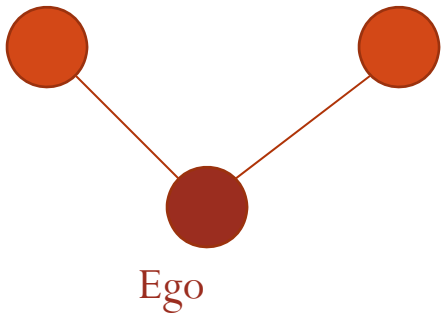
- Alter j constrains i to the extent that
  - i has invested in j
  - i has invested in people (q) who have invested heavily in j. That is, i's investment in q leads back to j.
- Even if i withdraws from j, everyone else in i's network is still invested in j

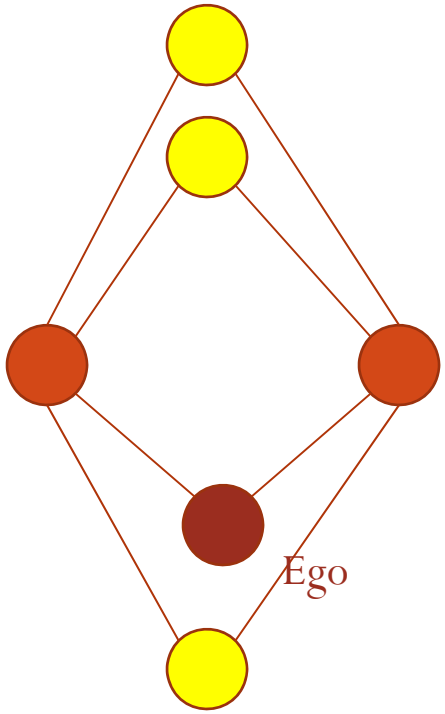
Controlling for size

- Should one control for degree when using measures of structural holes?

Limitations of burt measures

- What if ego is not the only broker between alter 1 and alter 2

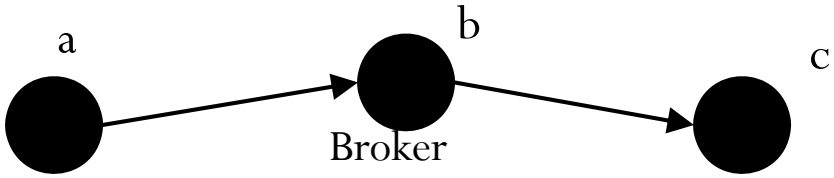




Do actors need to be aware of structural holes to benefit from them?

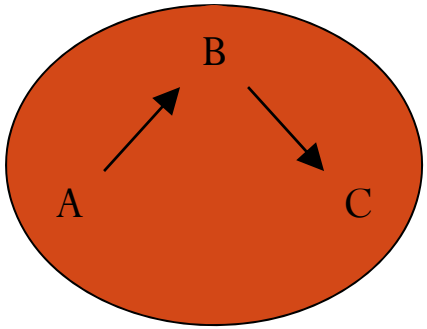
- For information benefits, no
  - Although it might help to recognize that your group 1 friends have solutions that group 2 doesn't
- For control benefits, more so

Brokerage Roles

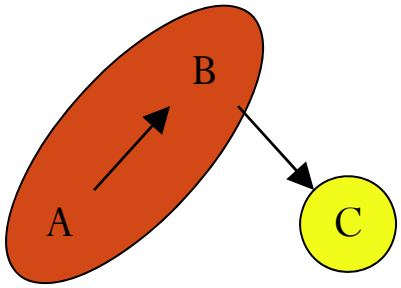


- Gould & Fernandez
- Broker is middle node of directed triad (note: a is NOT connected to c)
- What if nodes belong to different organizations?

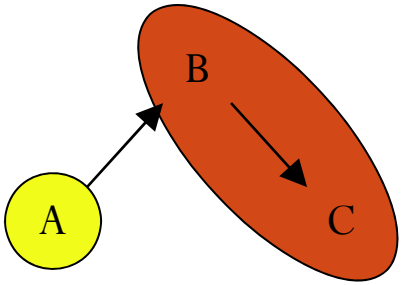
Brokerage Roles



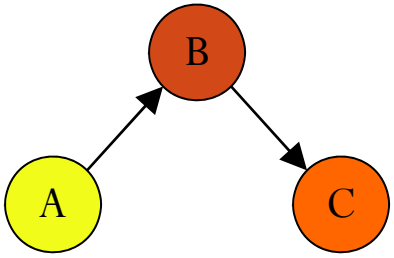
Coordinator



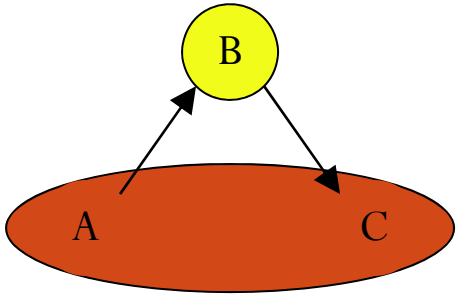
Representative



Gatekeeper



Liaison

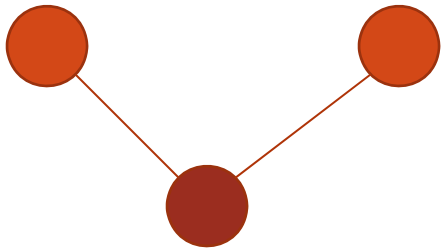


Consultant

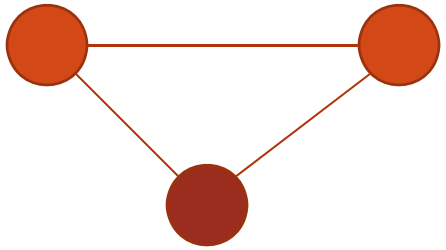
- We can count how often a node enacts each kind of brokerage role

Brokerage as process

- So far we have identified brokerage with a particular network shape
- But brokerage can also occur when the brokered are already connected
  - Catalyst to do something
- Marriage and real estate brokers both exist to create a tie of some kind



Broker



Broker